Fundamentals of Nanotechnology

Nanotechnology · Practice Test · 15 Questions

1. What is the approximate size range of objects defined as 'nanoscale'?

A) 1 to 100 micrometers
B) 1 to 100 nanometers
C) 100 to 1000 nanometers
D) 0.1 to 1 nanometers

2. Which material is an allotrope of carbon consisting of a single layer of atoms arranged in a two-dimensional honeycomb lattice?

A) Fullerene
B) Diamond
C) Graphene
D) Carbon Nanotube

3. What is the primary reason gold nanoparticles appear different in color (e.g., red or purple) compared to bulk gold?

A) Surface plasmon resonance
B) Chemical oxidation
C) Increased density
D) Radioactive decay

4. Scanning Tunneling Microscopy (STM) is primarily used for which purpose in nanotechnology?

A) Measuring electrical resistance of fluids
B) Imaging and manipulating individual atoms
C) Calculating the atomic mass of molecules
D) Determining the crystal structure of large metals

5. Which phenomenon describes the increase in a material's surface area to volume ratio as its particle size decreases?

A) Quantum confinement
B) The scaling effect
C) Thermal expansion
D) Surface energy saturation

6. What are 'buckyballs' (Buckminsterfullerenes) chemically composed of?

A) 60 atoms of silicon
B) 60 atoms of carbon
C) 60 atoms of gold
D) 60 atoms of nitrogen

7. Which of the following is a common application of silver nanoparticles in consumer products?

A) Reinforcing structural concrete
B) Improving electrical conductivity in copper
C) Providing antimicrobial properties
D) Increasing the hardness of glass

8. What happens to the band gap of a semiconductor as its size reaches the nanometer scale due to quantum confinement?

A) It remains constant
B) It decreases
C) It increases
D) It disappears entirely

9. Titanium dioxide nanoparticles are widely utilized in sunscreen due to their ability to perform which function?

A) Reflect or absorb ultraviolet radiation
B) Chemically react with skin oils
C) Generate heat to kill bacteria
D) Provide a waterproof barrier through polymerization

10. What is the main challenge in 'bottom-up' nanotechnology manufacturing?

A) The lack of raw materials
B) Controlling the precise assembly of individual atoms
C) The extreme heat required for fusion
D) The inability to use carbon-based materials

11. Which term refers to the method of creating nanostructures by removing material from a larger block?

A) Self-assembly
B) Top-down fabrication
C) Molecular deposition
D) Chemical vapor synthesis

12. Superhydrophobic surfaces, such as those inspired by the lotus leaf, often rely on which nanostructure property?

A) Atomic smoothness
B) Nano-scale surface roughness
C) Increased chemical polarity
D) Magnetic attraction to water

13. What is a carbon nanotube characterized as?

A) A long, hollow cylinder of graphene
B) A sphere of bonded carbon atoms
C) A thin sheet of diamond
D) A stack of graphite layers

14. Ferrofluids are colloidal liquids made of nanoscale ferromagnetic particles suspended in a carrier fluid. How do they respond to a magnetic field?

A) They turn into gas
B) They change color
C) They form spike-like patterns
D) They become electrically insulating

15. In the context of nanotechnology, what does the acronym 'MEMS' stand for?

A) Molecular Electronic Measurement Systems
B) Micro-Electro-Mechanical Systems
C) Macro-Engineering Materials Science
D) Minimal Energy Molecular Structures